



Multimodal dairy cow–human interaction in an intensive farming context

Leonie Cornips^a, Marjo van Koppen^{b,*}

^a NL-Lab (KNAW) and Maastricht University, Netherlands

^b Meertens Instituut (KNAW) and Utrecht University, Netherlands



ARTICLE INFO

Article history:

Received 7 October 2021

Received in revised form 9 August 2023

Accepted 6 September 2023

Available online 31 October 2023

Keywords:

Animal turn in linguistics

Interspecies ethnography

Conversation analysis

Cow-human interaction

Embodied language

Gaze and turn taking

ABSTRACT

In our consideration of how to decentre an anthropocentric view in linguistics, we will address the following research question: how do dairy cows and humans imbue their interspecies interaction as a semiotic resource with meaning that makes sense for both species under specific social conditions (Jørgensen, 2008:167). We address the question by using a social-interactional approach informed by conversation analysis (CA) (Goodwin, 2017, Mondada, 2016, 2018; Mondémé, 2021), which enables us to examine what the dairy cow makes relevant in the sequential organisation when interacting with a human.

We show that the dairy cows make gaze important in their interaction. Gaze alone is sufficient to mobilize human interlocutor response, and gaze withdrawal by the human should take place for a successful communication (case-study 1 versus study 2). The case-studies of dairy cow–human interactions show that these interactions include much more than (human) sounds and (human) signs only: language is taken as languaging, as a social practice, embedded in a multimodal interactional exchange (Levinson and Holler 2014) that includes nonhuman animals as well. This also implies that linguists should therefore look beyond ‘sound’ and ‘sign’.

© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

1. Introduction: an animal turn in linguistics¹

This paper shows our epistemological commitment to make a case for an animal turn in linguistics (Cornips, 2019, 2022, 2024) as a way of critically engaging with anthropocentric views (Meijer, 2019) that have created deep asymmetrical power relations between human and animal others. To this end, we critically ask “the question as to why it is so natural to draw an a-priori basic distinction, claimed to be universal, between humans and other animals in linguistics” (Pennycook, 2018). These a-priori distinctions in the linguistic literature are of many different kinds. Hockett (1958: 574), for example, has suggested specific features ascribed to human language only: the duality of patterning, productivity, arbitrariness, interchangeability, specialization, displacement, and cultural transmission. A second example is Hauser et al. (2002), who have hypothesized that recursion makes human language unique. A third example is taken from Fromkin et al. (2011:3) who argue that “(t)he possession of language, perhaps more than other attributes, distinguishes humans from other animals. To understand our humanity, one must understand the nature of language that makes us human”. They also note (2013: 23–24, 117) that

* Corresponding author. Meertens Institute, t.a.v. Marjo van Koppen, Oudezijds Achterburgwal 185, 1012 DK Amsterdam, Netherlands.

E-mail address: marjo.van.koppen@meertens.knaw.nl (M. van Koppen).

¹ We like to thank the various anonymous reviewers for all their constructive feedback. We are also grateful to the participating farmers for all support, and of course to all the dairy cows participating in our fieldwork.

“Language is a system that relates sounds and gestures to meanings (...) but their [animals/authors] utterances carry no meaning” and “Whatever the signal means, it is fixed. Only one meaning can be conveyed”.

In our view, in order to achieve a more inclusive linguistics, the assumed exceptional nature of human language should not take centre stage; the basic assumption in linguistics should be that sounds produced by nonhuman animals have meaning for nonhuman animals of the same species and humans that are initiated in the interaction of these animals and/or other animal species. That nonhuman animal sounds are considered meaningless in linguistics or only seem to convey a fixed meaning for most human animals is the result of humans not being able to understand or not willing to decentre themselves and/or invest in trying to find out what nonhuman animals are communicating rather than the restrictive capability of expressing meaning of nonhuman animal language. Hence, there is clear evidence that dairy cows express various meanings via vocalizations. [Jahns et al. \(1997\)](#) and [Jahns \(2012\)](#) identified by the vocalizations of individual cows (inter-class properties) and specific states of a given cow (intra-class properties), using an experimental elicitation methodology that put the individual cow deliberately in a state of hunger, clawing, trimming etc. Their corpus consisted of 688 recorded calls (moos) from 39 cows whose utterances were manually labelled for seven different meanings. 70% of these calls (481.6) were used to train the Hidden Markov Model and 30% (206.4 calls) were used for validation. Their findings were highly accurate as to the meaning of a specific vocalization, with a 100% accuracy for the sound of a calf separated from its mother, of an adult cow for its calf or of a hungry adult cow.

In addition, [Padilla de la Torre et al. \(2015\)](#) observed and recorded 344 mother–calf contact calls (cows – 205 calls; calves – 139 calls) of 31 individuals (17 cows and 14 calves) on a farm in Radcliffe on Trent (UK). The contact calls varied in frequency depending on their function. Mother cows produced very soft low frequency calls (fundamental frequency (F0) = 81.17 ± 0.98 Hz) when they were near their three- to four-week-old calves; these calls were made with mouth closed or only partially open. On the other hand, mother cows produced high frequency calls (F0 = 152.8 ± 3.10 Hz) when they were in a different field from their calves and when they preceded nursing. The calls were meaningful to their calves since they responded in observable behaviour, namely approaching the mother cow to be nursed. Thus, both [Jahns et al. \(1997\)](#), [Jahns \(2012\)](#) and [Padilla de la Torre et al. \(2015\)](#) provide evidence that cows have vocalizations in situated contexts that express meaning for their conspecifics.

Moreover, it remains to be seen whether a nonhuman animal signal is truly fixed since more recently the notion that language conveys meaning is taken much broader than sounds (as in human spoken language) and signs (as in human sign language). To this end, we will focus on interspecies multimodal interaction, to be more precise, on dairy cow (*bos taurus*) – human (*homo sapiens*) interaction in an industrial farming context.² More specifically, we will analyse two extracts relevant for the study of human–cow interaction that are also clear examples of cow-initiated focussed activities i.e. the ‘approaching cow’ and ‘vocalizing cow’. This particular focus takes a bovine-centric rather than an anthropocentric perspective, i.e. the cow is the starting point for the analysis and not the human.

Our paper is organized as follows: the next section, following our rationale why dairy cow–human interaction is worthwhile to study, provides the theoretical background. Section 3 discusses the methodology of the empirical data-collection of dairy cow–human interactions trying to decentre an anthropocentric view. In section 4 and 5 we apply Conversation Analysis (CA) to investigate how and which semiotic resources used by the dairy cow are organized in relation to another in two typical dairy cow–human interactions i.e. the ‘approaching cow’ and the ‘vocalizing cow’, respectively. The sixth section of this paper contains the discussion and ends with a conclusion.

1.1. Why study dairy cow–human interaction?

We study dairy cows as social co-beings in interaction with humans, and as individuals, which is unusual. Dairy cows and humans have a special bond: they have lived together since around 10,500 BC and dairy cows had to adapt their behaviour to recent intensive or industrial farming, and close contacts with humans ([Bos et al., 2018](#)) (both in farming and pastoral societies). Hence, focussed activities between dairy cows and ‘their’ humans are intense – it takes place on a daily basis (as opposed to human–wolf interactions, for instance. Further, in the global north cattle as production i.e. food animals are categorised differently than so-called companion animals which has a clear effect in multispecies interaction studies. Social and communicative skills ([Haraway, 2008](#)) of companion species and higher primates have been investigated in more detail while this is until recently lacking for production animals. The reason is that it is/was thought that dairy cows possess fewer complex abilities than dogs, cats, and chimpanzees ([George and Bolt, 2021](#)). Recent research, however, reveals that dairy cows possess long and short-term memories, can discriminate objects, have distinct personalities, stable personality characteristics, and clear capacities to lead rich and socially complex lives, which problematize their status as food commodities ([Marino and Allen, 2017](#)). Also, the categorisation of dairy cows as production animals is not everywhere the same around the globe since dairy cows can take on a sacred status in Hindu religion, for example ([Notermans, 2019:5](#)). Finally, [Hare et al. \(2002: 1635\)](#) suggest that selection processes during so-called domestication focussed on specific skills of social cognition and communication with humans, which may have favoured interspecies understanding. Importantly, also [Phillips \(2007\)](#) notes that non-domesticated cattle, as prey animals, would have been discouraged to use intraspecies communication with humans since it would attract predators, whereas nowadays “adequate communication [with humans/authors] is of vital importance in an intensively managed gregarious species” such as dairy cows

² The following disclaimer holds: our research does not presume legitimizing, authorizing and/or continuing the Dutch industrial and/or intensive dairy farming context, which can only be considered unethical ([Thompson, 2021: 208](#)). Rather, we emphasize our hope that linguistic research will contribute to understanding the dairy cow and improving her welfare, while simultaneously increasing human reflection on human exploitation of animal others.

find themselves in the Netherlands. The entanglements between cows and farmers in the Netherlands thus provide an excellent opportunity for studying interpersonal interactions between them (Cornips, 2022; Cornips and van den Hengel, 2021).

2. Distributed language

In our consideration of how to decentre an anthropocentric view in linguistics we understand language as a *distributed* phenomenon, an emergent property deriving from the interactions and interrelations between human and nonhuman actors, including spatial resources and things usually seen as inanimate (Pennycook, 2018; Thibault, 2011). As Pennycook (2018: 51) puts it, distributed language is: “a concept that challenges the idea of languages as internalized systems or individual competence and suggests instead an understanding of language as embodied, embedded and distributed across people, places and time”. As such language is “(...) part of a much broader set of semiotic possibilities, and meaning [of sounds, for example/authors] is not borne by words in isolation but emerges from local interaction involving the dynamics of sense, objects, places, and linguistic resources.” (Hua et al., 2017: 386) An animal turn in linguistics provides the opportunity to develop a theory of a relational framework focusing on language as local meaning-making distributed among and between species, materiality, place and time (Cornips, 2022). In this perspective, language is thus not considered as a fixed, bounded object but as languaging, as ‘doing in the world’, that is, as a social and situated practice belonging to (human and other animal) interactants (Gurney and Demuro, 2019:6; Otsuji and Pennycook, 2010:248). More specifically, we will provide an account of how the semiotically diverse resources that both humans and dairy cows use are organized in relation to another (Kendon, 2014:1). In this distributed view on language, we do therefore not limit ourselves to vocalizations of the dairy cow(s) but include a “whole range of bodily resources that are assembled and coordinated in languaging events together with external (extrabodily) aspects of situations, environmental affordances, artifacts” etc (Thibault, 2011:215, see also Keevallik, 2018). Dairy cows in an intensive farm context draw on semiotic linguistic resources that are not only produced by the vocal tract, but also by the sound of synchronizing bodies and, as encaged individuals, also on rhythmic clattering of iron bars (Cornips & van den Hengel, 2021). Hence, bars, fences, chains, cubicles, compost bedding, food and other material artefacts constitute daily life at an intensive dairy farm, which can become part of languaging.

In particular, we will address the following research question: how do dairy cows and humans imbue their interspecies interaction as a semiotic resource with meaning that makes sense for both species under specific social conditions (Jørgensen, 2008:167)? The question will be addressed by using a social-interactional approach informed by conversation analysis (CA) (Goodwin, 2017; Mondada, 2016, 2018; Mondémé, 2021), which enables us to examine what the dairy cow makes relevant in the sequential organisation when interacting with a human. To be more specific, we consider human and dairy cow language as “embedded within an interactional exchange of multi modal signals” (Levinson and Holler, 2014:1) such as gaze, sounds, movements, facial expressions (kinesics), touch (haptics), space (proxemics), and sensorial capacities in which bodily behaviour is inseparable from speech, syntax and semantics (Mondada, 2016:399). We position our research as follows: we follow Mondémé (2021:3) in our study of sequential organisation in interspecies dairy cow-human interaction as a crucial site where “(t)wo species need to adjust to one another, admittedly building on the particularities of their species-typical behavioral repertoires, but procedurally trying to make sense out of it, thus creating emergent ways of interacting and acting together.”

Of course, we can only get to ‘know’ the cow from a human perspective (Buller, 2014), but conducting an ethnography (see later) is at least a so-called bottom-up methodology in the words by De Waal and Ferrari (2010). They define a bottom-up methodology as an Umwelt-methodology: “in the footsteps of Kafka and Von Uexküll we are trying to get under the skin of other species, trying to understand them on their terms.” (De Waal, 2016:19). The choice of a multimodal interactional analysis of the sounds, gaze, movements, facial expressions (kinesics), touch (haptics), space (proxemics), and sensorial capacities of cowhuman interaction runs the potential hazard of anthropomorphism in attributing human cognitive, and social capacities to dairy cows (De Waal, 1999). However, we follow De Waal’s footsteps here who argues that anthropomorphism can be used “not to find some quality in an animal that is precisely equivalent to our own inner lives. Instead, the fact that we are animals is exploited to develop testable ideas (see Heuristic Anthropomorphism)” (De Waal, 1999:261). Crucially, to coordinate interaction with dairy cows, we do not have to access the ‘inner’ experience of them since, as Mondémé (2021:11) states, “there is no need to adjudicate on the thorny problem of animal intentionality to observe the orderly accomplishment of complex joint actions—and to analyze them accordingly.”

3. Multispecies (or rather bispecies) ethnography

Research on nonhuman linguistics requires a different methodology (Seymour and Wolch, 2009) from what is common in human linguistics.³ We cannot query dairy cows on their intuitions or acceptability judgements, on what their vocalizations mean, on what the restrictions on these patterns are, etc. We cannot conduct interviews and there are no corpora to use. Since we cannot communicate with dairy cows about their linguistic resources in any obvious way, the only way forward is to decentre an anthropocentric view, and observe carefully the interactive, observable, multimodal behaviour of relating cows and humans if we wish to gain an understanding of interspecies intersubjectivity. Moreover, ethnography is exemplary in

³ The first author will be indicated by L., the second one with M.

order to examine language as a situated practice, and the interrelations and interactions between interactants in the here-and-now (Cowley, *forthc.*).

L. has been conducting fieldwork since the summer of 2018 (see Fig. 1 below in §2.2). Her fieldwork can be characterized as a multispecies, or rather, interspecies ethnography (Kirksey and Heimreich, 2010), geared towards acquiring knowledge of the resources (vocal, bodily, material, sensorial, spatial, and temporal) of the dairy cow as a subject. An ethnography does not make the categorical division between human and other animals, thus lending itself especially to new and unstudied communities (Buller 2018; Hodgetts and Lorimer, 2015). This methodology entails observing cows and farmers and building up trust (Duranti, 1997) with them. Observation takes place inside the barn and outside on pasture, with embodied fieldwork promoting a shared understanding between human and cow via bodily experiences like brushing, touching, milking, feeding, walking, and in general spending time with them (DeMello, 2012, Haraway, 2008). The focus is on observing interrelations and interactions between cows, and between cows and farmer(s), which appear as recognizable events (Bhatia, 1993) for human researchers, like entering the barn (Cornips, 2022), feeding, and eating (De Malsche and Cornips, 2021), playing, care giving, milking, calf birthing, as well as troubling interruptions such as the death of a fellow cow or mother-calf separation. The exact focus of the observations on how the cows relate with conspecifics and the human(s) evolves and emerges during the data collecting process (Dörnyei, 2007), which relies on long-term and systematic observation (Johnstone, 2000:9).

3.1. Fieldwork locations

Fig. 1 shows the ten field work sites, cattle breeds, barn designs and number of cows which, for our purposes, constitutes a sufficiently broad sample of coverage of the different kinds of Dutch dairy farms. It is not our aim in this study to (quantitatively) assess the role and interaction of factors like e.g., cow breed, farm design and number of cows (as is often the case in applied biology research). Rather, we aim at a qualitative analysis of observable embodied interpersonal i.e., interactional behaviour in situated contexts (see Stukenbrock, 2020:2).

	LOCATION	BREED	N	BARN TYPE	BRANCH	MILKING	FIELD WORK (D/M,Y)
1	Norway	Scandinavian red	35	Tie-stall	Milk	Milking parlor	21/10, 2018
2	Amsterdam	Fleckvieh	30	Tie-stall	Cheese A2 Milk	mobile manual milking machine	3/5, 18/7, 18/8, 19/9, 12/10, 22/10 2019; 4/2, 6/5, 14/5, 22/9, 15/10/, 1/12/ 2020; 9/3/, 7/5/ 14/5, 3/4/, 16/4, 13/8, 2021
3	Nijmegen	Montbéliarde	80	Loose housing	Milk	Milking parlor	7/16, 2019
4	Maastricht1	Holstein-Friesian	>150	Loose housing	Milk	Robot milking	5 (1 month), 27/7, 17/8, 18/8, 2018
5	Maastricht2	Holstein-Friesian	50	Loose-housing	Milk	Milking parlor	15/2, 28/4, 2019
6	Rotterdam	Holstein-Friesian	120	Loose housing	Milk	Milking parlor	11/3, 19/12, 2018
7	Utrecht1	Holstein-Friesian	120	Loose housing	Milk	Milking parlor	As holidaymaker present many weekends in summer since 1996
8	Utrecht2	Holstein-Friesian	75	Loose housing	(biological) Milk	Milking parlor	28/7, 2020
9	Cow sanctuary	Various	50	Tie-stall Loose housing	none	none	15/12, 2020, 24/3, 16/12, 2021
10	Dairy cow museum	'Old Dutch breeds'	30	Tie-stall Pot barn	none	none	8/8, 10/10, 2021

Fig. 1. Fieldwork sites, types of cows, barns, and dates of fieldwork.

Fig. 1 shows that since summer 2018 fieldwork has taken 64 days (and twenty times as much if barn 7 is fully included), resulting in about 100 h of videorecording, 100 photos, and 122 pages of field work notes (50,000 words). No structured interviews were conducted with the farmers of the 10 b since they were mostly present during fieldwork, thereby casually informing how they manage the farm, how they take care of the cows and calves, their problems with how to secure their farm and how to secure future farming life for later generations, and importantly, how they interpreted the multimodal behaviour, including vocalizations, of ‘their’ dairy cows.

The authors conducted fieldwork together in *barn 2* (3–4, 2021) and *barn 6* (11–3 & 19–12, 2018) (bold in Fig. 1). Barn 2 is a tie-stall barn in which, during winter (about 6 months), the cows are tied up in two rows facing each other, separated by an aisle for food. 45 Fleckviehs (all ages together) live in barn 2 and are milked with a mobile manual milking machine. Barn 6 is an industrial dairy farm housing about 150 Holstein Friesians, which had been divided into 3 b. The first barn is a so-called young cattle barn, the second one houses the dairy cows. The 2 b are so-called loose housing barns, and the dairy cows are milked twice a day in a computerized and automatic milking parlour.

In both barn 2 and 6, the new-born calves are separated from their mothers immediately after birth and placed in individual boxes, without the opportunity to touch or groom each other. In barn 2 these new-born calves are in the same barn as the other cows. In barn 6 they are placed in the third barn, separate from the somewhat older calves and heifers in the first barn, and milk-producing cows in the second b, respectively.

3.2. Methodological background of the interactions studied

The first type of dairy cow–human interaction, which we will call ‘the approaching cow’ took place in barn 6 – the loose housing barn – when a Holstein-Friesian cow approached M., resulting in the cow sniffing, touching, and licking her (see §3.1). This kind of interaction happens frequently during fieldwork in barns if the cow is not eating, ruminating, or sleeping. In loose housing barns where many individuals must live together, prolonged observations by the fieldworkers (see Fig. 1 above) as well as by the farmers confirm that about every 6th cow interacts in this way with humans entering the barn; in our fieldwork this adds up to at least 80 times when we consider all the dairy cows in the 8 loose housing barns in Fig. 1. Although this behaviour is frequent, not all cows approach humans, which should be attributed to earlier findings that cows have distinct personalities and stable personality characteristics (Marino and Allen, 2017; Colvin et al., 2017). This is also confirmed by the farmers, who report on different personalities of ‘their’ cows resulting in different behaviour towards themselves and other humans.

The second type of interaction, i.e. ‘the vocalizing cow’ took place between the farmer of tie-stall barn 2 – and a Fleckvieh cow (see §3.2). One of the cows got stuck in her chain and could not get loose by herself. When the farmer entered the barn, she began to vocalise, attracting attention of the farmer, who then started videoing her with his mobile phone while standing right in front of her without moving, and not talking to her during the videorecording. The farmer sent L. via WhatsApp the 17-s video clip featuring their interaction. This type of interaction between cow and farmer takes place regularly in tie-stalls where cows can get stuck in their chains and cannot untie themselves. This farmer is also particularly interested in what ‘his’ cows are communicating to him, hence his willingness to make the video and share it.

The two types of interactions are transcribed (see below for more discussion) and include “not only the spatial but also the sequential structure, the movement through time, of the events being studied” (Goodwin, 1986:30).

4. Excerpt 1: ‘the approaching cow’

The two types of interactions, i.e. ‘the approaching cow’ and ‘the vocalizing cow’ (see above), can be taken as two case-studies of communicative events (Bhatia, 1993) for initiated humans, i.e. the fieldworkers and the farmer. The communicative event is the main unit of analysis in genre analysis: how does an interaction function in the social world as a recognizable event for human observers. In this case, the communicative event consists of two participants (cow and human) engaging and there is eye-gaze and/or smell/lick/touch by the dairy cow and/or a (re)action by the farmer/fieldworker involved (see De Malsche & Cornips for goat-human interaction). The two communicative events of interaction ‘the approaching cow’ and ‘the vocalizing cow’ have this aspect in common. However, they differ in participants–fieldworkers or farmer – and type of barn. Materiality is important therefore (Cornips & Van den Hengel, 2021; Cornips, 2022): a cow cannot approach the fieldworkers (case-study 1, see below) in a tie-stall barn and a cow can never be caught in a chain in a loose housing barn (case-study 2, see below).

4.1. Conversation analysis: the approaching cow

During our fieldwork in barn 6 (see above), an individual cow approached M. while she was videorecording. The farmer and L. were at the far left of the barn, talking to each other. M. was not focussing on this specific cow – the cow was initially out of sight at the back – but on the cows standing directly in front of her behind the fencing of this part of the loose-

housing stall. The approaching cow enters the film while moving forward to M. who had her mobile phone at chest height, so that her face was completely visible to the cows. The entire video recording lasts 31 s but the interspecies focussed activity takes 19 s from the moment that the specific (red-white) cow notices M. until the cow touches M. with her nose, smelling and later licking her hand (not on the recording). The materiality of the barn, hence, the fence severely restricts the mobility of the dairy cow: she can touch, and lick M. only when putting her head over the fence. The snapshots in Fig. 2 illustrate this focussed activity.

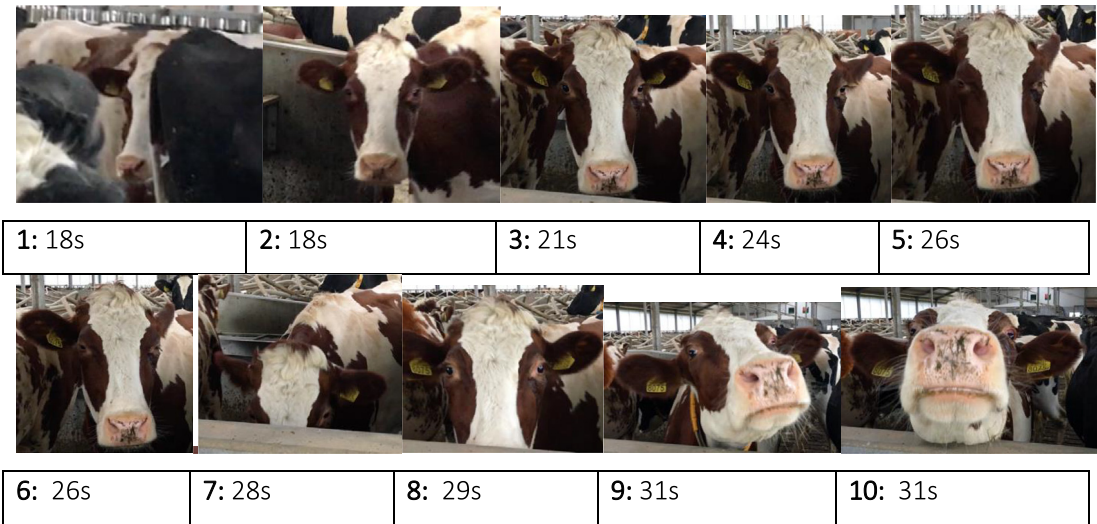


Fig. 2. Snapshots of the approaching dairy cow moving forward and initiating interspecies interaction with the filming fieldworker.

For the purpose of a social interactional approach we base ourselves on the transcription system in Mondada (2016), but then attuned to dairy cow behaviour in which moving forward, positioning of ears and head, in addition to gaze, are relevant.⁴ So, the purpose of the transcription in Excerpt 1 below is to show how these embodiments “feature in the organization of social interaction (...) and how they occur not alone but alongside a range of other embodied resources” (Mondada, 2018:89).

The cow’s behaviour may seem slow in the eyes of the human, i.e. the interspecies interaction visible on the recording takes about 20 s, but in fact the interaction takes longer since the protagonist has noticed fieldworker M. already before filming, so long before the fieldworker noticed her. The protagonist closing off the focussed activity with smelling, touching, and licking the fieldworker who is not visible on the videorecording.

Legenda (after Mondada, 2018)

- *----> The action described continues across subsequent lines.
- >*
- L.14 Line 14.
- >> The action described begins before the excerpt’s beginning.
- >> The action described continues after the excerpt’s end.
- Action’s preparation.
- Action’s apex is reached and maintained.
- '''''' Action’s retraction.
- fig exact moment at which a screen shot has been taken.
- # is indicated with the sign # showing its position within talk.
- M. Fieldworker.
- Protag dairy cow.

⁴ We are grateful to Lynn de Rijk for helping us with the transcription.

Excerpt 1 – dec19_2018 (18s-31s): ‘the approaching cow’

((the protagonist cow (red-white) noticed M. even before M. noticed her and she is moving toward M. while gazing (Video-recording starts at 0 until 31 seconds)))

- 1 Protag >>*moving towards M. -----* ----> L.6
 2 #*holds head above neck-----*----> L.17
 3 #holds ears straight out to the side *----> L.11
 4 #gazes at M.-----*----> L.16
 5 #head directed at M.-----*----> L.15
 Fig #Fig.3.



Figure 3 Protagonist (red-white cow) ((18s since start videorecording))

- 6 Protag #Stops moving forward, stands still in front of M. ----> L.17
 7 M. #Gazes at protagonist-----
 Fig #Fig.4.



Figure 4 protagonist (red-white cow) ((21s since start videorecording))

((A loud metal on metal sound can be heard in the barn left at the back from the protagonist’s perspective))

- 8 M. *turns her head into direction sound (to the right)*---->L.13
 9 but holds camera in similar position
 10 *interrupts gaze at protagonist-----*---->L.13
 11 Protag #*blinks left eye-----*
 12 #*turns left ear asymmetrically backward*
 13
 14 *blinks left eye*

Fig #Fig.5.



Figure 5 Protagonist ((24s since start videorecording))

- 15 M. *turns head toward protag*>>
 16 *resumes gaze at protag-----*.....>>
 17 Protag #*lowers head and neck below back*
 18 # *interrupts gaze-----*.....>L.19

Fig #Fig.6.

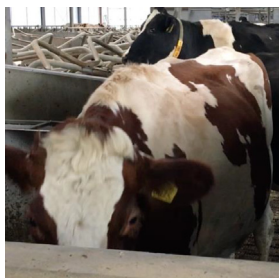


Figure 6 Protagonist ((28s since start videorecording))

- 19 Protag *Starts to move forward* --->
 20 Protag #*angles her head at the iron fence*
 21 #*resumes gaze at M,-----*
 22 #*puts head on iron fence----*
 23 #*puts nose forward-----*
 24 #nostrils wide open, smelling*....>>

Fig #Fig.7&

#Fig.8

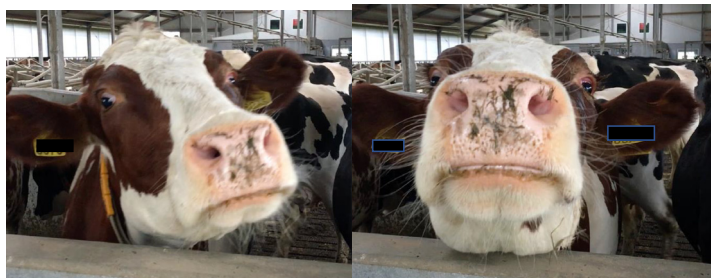


Figure 7 Protagonist ((31s since start videorecording)) Figure 8 Protagonist ((31s since start videorecording))

- 25 M. *''''''*
 26 Stops filming
 27 Protag ((Protagonist smells and touches m. with nose, then licks her hand))

The protagonist cow initiates the action by gazing at M., holding head and neck higher than her back, and ears (De Oliveira and Keeling, 2018) straight out to the side, perpendicular to the head-rump axis: an attentive, yet friendly, head position signalling friendliness (Fiems et al., 2018) (ln 7 through 10). At this point, M. is not yet consciously participating in the interaction (fieldwork notes 18 December 2018). From her perspective, she is merely carrying out her fieldwork, observing this cow and her behaviour; hence the reaction or her 'response' (from the perspective of the cow) is to keep looking at the cow. Although this observational gaze is not focussed from the point of view of M., the cow seems to interpret it that way. The cow stops moving and 'waits' for 8 s in front of M. while gazing at her (ln 6-7), possibly waiting for an appropriate response that would indicate that M. either wants to engage in a focussed activity with her or not. The distance at which the protagonist stops (ln 5) is probably determined by her sight potential. A cow's "visual acuity is less than 1/50th of that possible in humans" (Phillips 2007:50) and the position of the eyes on the side of her head results in limited stereoscopic vision at short distances (Phillips 2007: 51), which may explain why the protagonist stops at this specific distance in front of the fieldworker. At this distance, a dairy cow has an overlap of her eyes which they have at only 30° to 50° compared to 140° in humans (Phillips, 2007:51). It might be the case that at that distance smelling and olfactory capacities take over from seeing, since olfactory confirmation by the cow takes place at close quarters (Phillips 2007: 86), and olfactory signals of a human enable a cow "to know a person's mood before any other communication has taken place" (Phillips 2007:219).

M. unintentionally responds to the cow when there is a distracting sound somewhere to the left of the cow and to the right of M. (around sec 25-27, ln 7-8). The interacting cow turns her left ear towards this sound, but maintains her gaze at M., possibly still anticipating a response (ln 12). M. also hears the sound and turns her face towards the position of the sound, averting her gaze away from the cow (ln 8-9). The cow's blinking (ln 11&13) may indicate gaze change (see also Excerpt 2) as in human dyadic interaction (Cummins, 2012). From the ensuing interaction (ln 17), we tentatively conclude that the cow interprets the gaze aversion by M. as a positive response to her initiation of the focussed activity and concomitant approach of M. This means for the protagonist cow that she can now move into the space of M. with a head position signalling accommodation – (see fig. 6.) (Fiems et al., 2018:8). Hence, by looking back at the cow when M. resumes the observation (ln 15), she (accidentally) gives the go-ahead for the continuation of the interaction and the cow starts to approach M. The approach is accompanied by gaze interruption of the cow (ln 17-18), which again means that it is now the turn of the cow again.

Taken together, the applied social interactional analysis reveals that a cow combines types of bodily postures with other embodied and sensorial expressions, so as to make up patterns of interaction systematically.

4.2. Social-interactional analysis: gaze, gaze aversion and olfactory capacities

Gazing in social interaction between humans has been analysed in detail. Gaze can initiate a focussed activity, as argued by Rossano (2013), co-articulated with bodily postures and related emotional states (see Fiems et al., 2018; Ochs et al., 1979; Schegloff, 1968, 2007). In early acquisition of human language, for example, eye gaze and attention getting are considered aspects of communication crucial to later human language development (e.g. Cates et al., 2012 and references cited there). In adult human language, gaze alone is sufficient to mobilize interlocutor response, and gaze withdrawal signals sequence closure (Rossano, 2013: 318). Also in three, hence in multi-party interaction, gaze by the current speaker is relevant for the selection of the next speaker (Auer, 2018).

Furthermore, gaze behaviour may differ in sequential organization, culturally as well as across species (ibidem). Bonobos, for example, use gaze frequently to address the interlocutor before giving a signal, while chimpanzees use more body orientation (Fröhlich et al., 2016). Gazing and gaze alternation in interspecies communication with humans "are often interpreted to have a referential communication function" (McElligott et al., 2020). Nawroth et al. (2016) show that goats gaze earlier and for a longer period when humans are facing them than when they are facing away: goats thus recognize humans and change their own gaze behaviour in accordance with their presence. De Malsche and Cornips (2021) report that in goat-human interactions at a goat dairy/petting farm "both the human participants and the goats attempted to make their communicative goals salient to one another by means of changes in body orientation and gaze". Kangaroos turn and lift their heads to actively gaze at a human experimenter during an unsolvable problem task and in addition show gaze alternations between the task and the human experimenter (McElligott et al., 2020).

CA (see Excerpt 1) emphasizes the relevance of gaze and gaze aversion in the emerging interspecies focussed activity between the dairy cow and the fieldworker (Mondémé, 2021:13). The sequence of gaze interruption of the human (line 9) and the cow (ln 16-17) in Excerpt 1 is a pattern also found in human-human interaction (see e.g. Kendon, 1967; Degutyte and Astell, 2021): a gaze by person A can be interpreted as a summons and conversation initiation. This initiation, and hence the emergent conversation, is confirmed by the 'turn' taking of interlocutor B, which is accompanied by gaze aversion. The turn can go back to the initiator A when B gazes at A again. However, this sequence depends on conversational activity type

although gaze is an explicit form of addressing a participant (Rossano, 2013:314), assuming that the addressee receives the gaze (Rossano, 2013:316).

Excerpt 1 also provides food for thought on an important issue. We humans cannot detect, and hence, transcribe the olfactory signals that dairy cows exchange in intraspecies and in interspecies interaction. Dairy cows have olfactory abilities comparable to dogs (Marino and Allen, 2017) and “are able to detect odeurs from inanimate and animate objects and utilise the information to modify their reproductive, ingestive or social behaviour” (Phillips 2007: 55). The vomeronasal organ, absent in humans, is crucial in perceiving olfactory signals and is situated in the roof of the mouth (Phillips 2007) and not visible when observing cows. Figs. 7 and 8 in Excerpt 1 show the wide-open nostrils of the approaching protagonist cow which are important for smelling M. Furthermore, cows use their extended mouth (comparable to the sensitivity in the fingertips of humans) for exploration and detection (Phillips 2007: 58), as the protagonist does when touching M. (In10).

5. Excerpt 2: ‘The vocalizing cow’

This section examines the interspecies interaction between a Fleckvieh cow and the human farmer in a tie-stall barn (barn 2, see Fig. 1), again as an orderly sequence of events (see Fig. 9) in which the cow crucially employs gaze, in addition to vocalizing. In a tie-stall barn a dairy cow is tethered at the neck to ‘her’ rod, hence, tied up for resting, feeding, ruminating, milking, delivering, and watering for about 6 months in late autumn, winter, and early spring. The cows stand in a row touching each other while facing the opposite row with others from the herd, divided by a feeding, and a human walking alley. Getting caught in the neck-chain happens in a tie-stall barn, and the farmer entering the barn knows immediately what is happening, and how to solve it. Indeed, what happened was that the front leg of the Fleckvieh ‘vocalizing’ cow had got caught in her neck-chain and she was unable to get up and stand like her neighbours, in fact, she could *not* move at all. The farmer, however, does not solve the situation directly as usual since he is videorecording this interaction for as long as possible to assist L.’s research. He stood still and remained silent while videorecording:

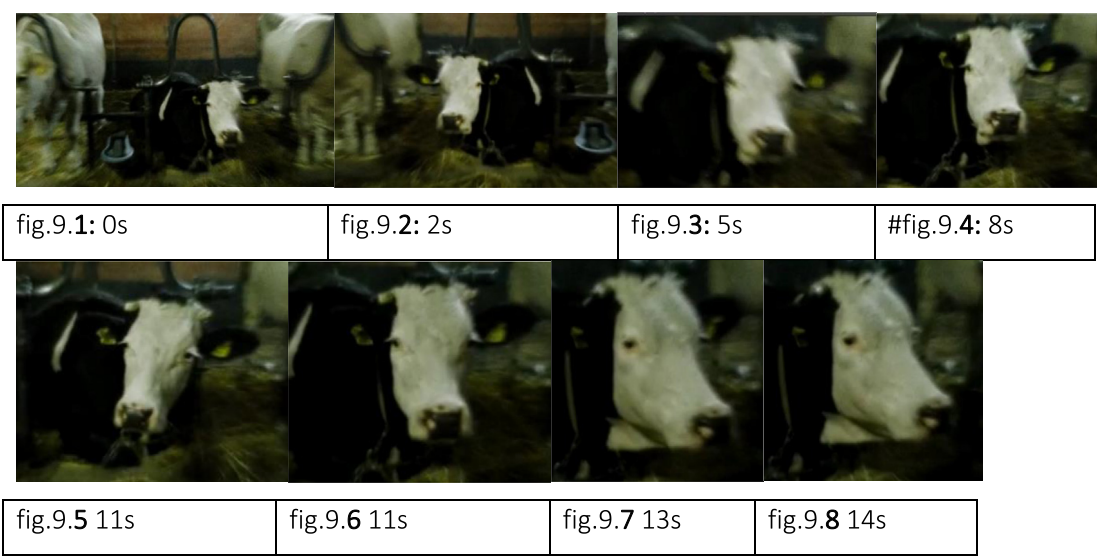


Fig. 9. Snapshots of the vocalizing dairy cow initiating interspecies interaction with the (filming) farmer.

Fig. 9 and the CA analysis below show the interspecies interaction in which the cow produced the three sounds with mouth closed, directed at the farmer while gazing at him (9.2, 9.3 & 9.4), while two are uttered when averting gaze (9.7 & 9.8). The specific multimodal behaviour emerges from focussed activity between the Fleckvieh cow and the farmer, and materiality such as the neck-chain, and rod.

F Farmer

Protag Cow

Excerpt 2 – oct22_2019 (0s-17s): ‘the vocalizing cow’

((The cow’s front leg is caught in her neck-chain and she is unable to get up and stand upright like her neighbors. The farmer is facing her while (video)recording)).

- 1 F: #Farmer films ----->
- 2 Protag:# head positioned towards farmer ----->*L.8
- 3 Protag:# gazes ----->*L.8
- 4 Protag:# ears straight out to the side*----->*

Fig #Fig 10



Figure 10 The cow’s front leg is caught in her neck-chain ((start videorecording))

- 5 Protag:#*vocalizing*

Fig #Fig 11



Figure 11 Cow is vocalizing once ((2 sec after start videorecording))

- 6 Protag:(0.3) *vocalizing*
- 7 Protag:(0.3) *vocalizing*
- 8 Protag:(0.3) *turns head to the right*
- 9 Protag: averts gaze
- 10 Protag: *turns head to farmer, establishing gaze*
- 11 Protag: *blinking*
- 12 Protag: turns head to the left
- 13 Protag:(0.6) *vocalizing*
- 14 Protag: ears backwards ----->L.14
- 15 Protag:(0.3) *vocalizing*
- 16 Protag: ears sideways----->
- 17 Protag:bows head to the ground

The farmer places himself almost in front of the Fleckvieh cow to record her. The cow positions her head toward the farmer, head positioned above the neck, her ears sideways (9.1 through 9.4; ln 2 through 7 in Excerpt 2): in so doing, she catches the eye of the farmer and vocalizes five times (ln 5,6,7,13 & 15). After three vocalizations directed at the farmer (ln 5,6 & 7), the cow turns her head to the right, interrupts her gaze (ln 8), establishes gaze again for a moment (ln 10) but after no response or action by the farmer, – since he is videoing – she turns her head away from him again (ln 12) after blinking (ln 11) but now to the left, while vocalizing twice (ln 13 & 15) – not directed at the farmer – and bows her head (ln 17, end of video-recording). The spectrogram in Fig. 12⁵ shows that the first three sounds (lines 5,6 & 7) while gazing at the farmer (line 3 through 8) differ in length, intensity, loudness, and pitch, while the two last sounds, uttered when the cow turns her face sideways and averts her gaze (ln 13 & 15), differ in loudness and pitch.

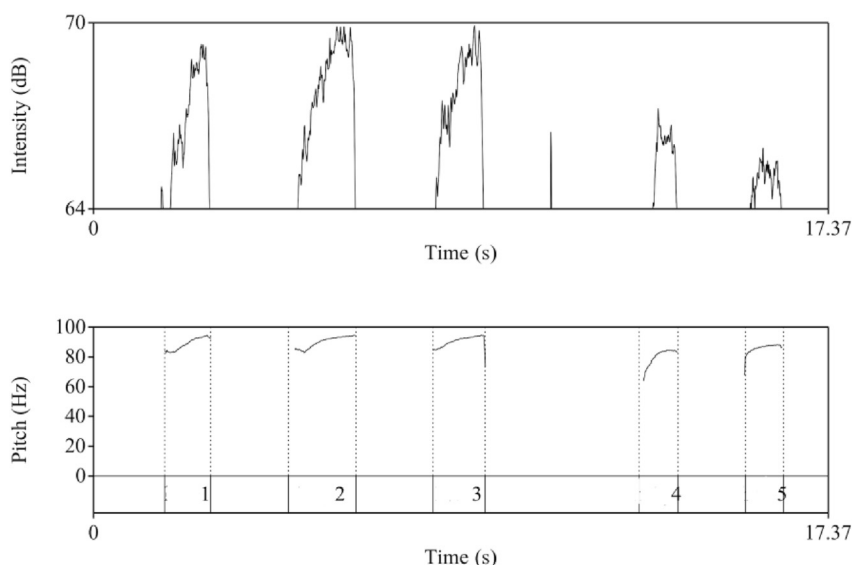


Fig. 12. Spectrogram of five consecutive sounds.

The second call (ln 6) by the cow is the longest of the three directed at the farmer and louder and higher in pitch than the first one. The cow produces a third call (ln 7) while gazing at the farmer; this one is louder and higher in pitch than the second one. In fact, the spectrogram shows that the first three sounds directed at the farmer are uttered in a steadily increasing higher pitch and loudness. However, when we look at the absolute length of the pitch contours, the second sound has the lowest pitch and the third the highest. The second call (ln 6) could thus be taken to be the most urgent after the farmer's neglect of her first call. In contrast to the interspecies action in Excerpt 1, this interaction may be considered as not successful from the perspective of the cow since the farmer does not unchain her front leg immediately. As a result, the cow turns her head sideways, hence averts her gaze and vocalizes twice, directed at no one in particular, eventually ending the interaction by bowing her head towards the ground.

This focussed activity between the protagonist dairy cow and the farmer includes three vocalizations by the cow that can be seen as attempts to get the situation resolved around her leg that has got stuck. The signal the protagonist uses to get a response is both gaze and vocalization simultaneously. As for the cow, her efforts do not lead to a positive response by the farmer. When we take the perspective of the farmer, then we know from his own explanation that he grasps the communication of the cow as analysed above in Fig. 12 already after her first vocalization. However, he chooses not to respond to the cow immediately, because he wants to continue the videorecording. This is probably why the cow redoubles her vocalization and continues gazing at the farmer.

6. Conclusions

This paper aims to describe a pathway for linguistics to transcend the assumptions of human exceptionalism and species hierarchy in order to try to understand initiated interactions of dairy cows with humans. It explores the hypothesis that “doing language” by nonhuman animals with human animals in interspecies communication, in this case between dairy cow

⁵ We are grateful to our colleague Etske Ooijevaar for her help with the analysis of these vocalizations.

and human, can be analysed on a par with interactions between human animals. The paper is inspired by linguistic knowledge and tools developed for human linguistics i.e. conversation analysis (CA) applied to multimodal behaviour of dairy cows. By applying CA to the interaction between humans and cows it has become possible for the first time to describe and analyse in detail how an interaction between a dairy cow and a human comes into being and proceeds; also, which semiotic resources might be relevant and how they are organized in relation to one another in understanding the dairy cow induced interspecies interaction in more detail. The CA analysis applied in Excerpt 1, i.e. 'the approaching cow', shows that the protagonist cow manages to make clear to fieldworker M. that she wants to engage in interaction with her, with the final aim to touch and lick her (body). Although initially M. was not aware that the cow was interacting with her, the cow managed by gazing, head and ear position, and moving toward her to engage her in interspecies focussed activity. The CA analysis also shows how averting gaze and looking back by both cow and M. is interpreted as a readiness to engage further in the interaction. Engaging in interaction with an approaching cow concretely means that the cow will move into the space of the interlocutor (Mondada, 2016) because the interaction will lead to touching and licking. The second case-study reveals that the protagonist cow is vocalizing five times, three times of which are directed at the farmer. The CA analysis shows an unsuccessful interaction from the perspective of the protagonist cow: she fails in getting the farmer to untie her front leg immediately. As a result, the cow averts gaze and bows her head to the ground.

We have provided a social-interactional approach to two communicative events in which a dairy cow and a human interact and imbue their interspecies interaction with meaning as a semiotic resource which makes sense for both species under specific social conditions. It reveals how and which semiotic resources used by the dairy cow are organized in relation to another. Both protagonist dairy cows in excerpt 1 & 2 mobilize embodied resources when they interact meaningfully with humans in what appear to be systematic patterns (Mondada, 2016:348). They show which semiotic resources are used by the cow and how; initiating, and ending a focussed activity with a human by positioning herself in the space (excerpt 1), vocalization (excerpt 2) and position of head and ears, blinking, and gaze aversion (excerpts 1 and 2).

What the dairy cows make important in their interaction is that gaze alone is sufficient to mobilize human interlocutor response, and that gaze withdrawal by the human should take place for a successful communication (case-study 1 versus study 2). The case-studies of dairy cow–human interactions exemplified how we can take the concept of language to convey a much broader meaning than (human) sounds and (human) signs only: language is embedded in a multimodal interactional exchange (Levinson and Holler, 2014) that includes nonhuman animals as well. This also implies that linguists should therefore look beyond 'sound and sign' for a theory of language. This attempt may lead to a more critical reflection on the (first and second order; Thibault, 2011) definition of language and on why a categorical distinction between humans and other animals is claimed to be universal. In doing so, linguistics may profit from and contribute to many new biological and ethological studies about nonhuman animal cultures, cognition, and emotion that support Darwin's thesis that differences between humans and other animals are of degree, not kind (Goldstein and Hall, 2021; Meijer, 2019).

Data availability

The data is extensively discussed in this paper. The video recordings can be made available upon request and under specific circumstances.

References

- Auer, P., 2018. Gaze, addressee selection and turn-taking in three-party interaction. In: Brône, G., Oben, B. (Eds.), *Eye-tracking in Interaction: Studies on the Role of Eye Gaze in Dialogue*. Benjamins, Amsterdam, pp. 197–231.
- Bhatia, V.K., 1993. *Analysing Genre: Language Use in Professional Settings*. Longman, London.
- Bos, J.M., Bovenkerk, B., Feindt, P.H., van Dam, Y.K., 2018. The quantified animal: precision livestock farming and the ethical implications of objectification. *Food Ethics* 2, 77–92.
- Buller, H., 2014. Animal geographies II: methods. *Prog. Hum. Geogr.*, 1–11.
- Cates, C.B., Dreyer, B.P., Berkule, S.B., White, L.J., Arevalo, J.A., Mendelsohn, A.L., 2012. Infant communication and subsequent language development in children from low-income families: the role of early cognitive stimulation. *J. Dev. Behav. Pediatr.* 33 (7), 577–585. <https://doi.org/10.1097/DBP.0b013e318264c10f>.
- Colvin, C.M., Allen, K., Marino, L., 2017. *Thinking Cows: A Review of Cognition, Emotion, and the Social Lives of Domestic Cows* [PDF file]. Retrieved from. <https://www.farmsanctuary.org/wpcontent/uploads2017/10/TSPCOWSWhitePaperVfweb-v2.pdf>. (Accessed 30 August 2021).
- Cornips, L., 2019. The final frontier: non-human animals on the linguistic research agenda. In: Berns, J., Tribushinina, E. (Eds.), *Linguistic in the Netherlands*. John Benjamins, Amsterdam, pp. 13–19.
- Cornips, L., 2022. The animal turn in postcolonial (socio)linguistics: the interspecies greeting of the dairy cow. *Journal of Postcolonial Linguistics* 6, 210–232.
- Cornips, L., 2024. How (dairy) cows and human intertwine languaging practices: recurrent vocalizations are not the same. In: Cowley, S., Döring, M., Vork Steffensen, S. (Eds.), *Ecolinguistics: Languaging and Living*. Bloomsbury Publishing, In press.
- Cornips, L., van den Hengel, L., 2021. Place-making by cows in an intensive dairy farm: a sociolinguistic approach to nonhuman animal agency. In: Bovenkerk, B., Keulartz, J. (Eds.), *Animals in Our Midst: The Challenges of Co-existing with Animals in the Anthropocene*. Springer, pp. 177–201.
- Cowley, S. *Forthc. Ecolinguistics in Practice*.
- Cummins, F., 2012. Gaze and blinking in dyadic conversation: a study in coordinated behaviour among individuals. *Lang. Cognit. Process.* 27 (10), 1525–1549. <https://doi.org/10.1080/01690965.2011.615220>.
- Degutye, Z., Astell, A., 2021. The role of eye gaze in regulating turn taking in conversations: a systematized review of methods and findings. *Front. Psychol.* 12, 616471.
- DeMello, M., 2012. *Animals and Society. An Introduction to Human-Animal Studies*. Columbia University Press, New York.
- De Malsche, F., Cornips, L., 2021. Examining interspecies interaction in light of discourse analytic theory: a case study on the genre of human-goat communication at a petting farm. *Lang. Commun.* 79, 53–70.

- De Oliveira, D., Keeling, L.J., 2018. Routine activities and emotion in the life of dairy cows: integrating body language into an affective state framework. *PLoS One* 13 (5), e0195674.
- De Waal, F.B.M., 1999. Anthropomorphism and anthropodenial: consistency in our thinking about humans and other animals. *Phil. Top.* 27 (1), 255–280. <http://www.jstor.org/stable/43154308>.
- De Waal, F.B.M., 2016. *Are We Smart Enough to Know How Smart Animals Are?* Granta Publications, London.
- De Waal, F.B.M., Ferrari, P.F., 2010. Towards a bottom-up perspective on animal and human cognition. *Trends Cognit. Sci.* 14 (5), 201–207.
- Dörnyei, Z., 2007. *Research Methods in Applied Linguistics: Quantitative, Qualitative, and Mixed Methodologies*. Oxford University Press, Oxford.
- Duranti, A., 1997. *Linguistic Anthropology*. Cambridge University Press, Cambridge.
- Fiems, L., Tuytens, F., De Sutter, R., de Graaf, S., Sonck, B., 2018. Veilig omgaan met runderen. Ilvo: Instituut voor Landbouw en Visserijonderzoek, Mededeling 213, 1–48.
- Fröhlich, M., Kuchenbuch, P., Müller, G., Fruth, B., Furuichi, T., Wittig, R.M., Pika, S., 2016. Unpeeling the layers of language: bonobos and chimpanzees enage in cooperative turn-taking sequences. *Scient. Rep.* 6, 25887. <https://doi.org/10.1038/srep25887>.
- Fromkin, V., Rodman, R., Hyams, N., 2011. *An Introduction to Language*, 9th ed. Wadsworth Publishing.
- George, A., Bolt, L., 2021. Livestock cognition: stimulating the minds of farm animals to improve welfare and productivity. *Farm Practice Livestock* 26 (4), 202–206.
- Goodwin, C., 1986. Gestures as a resource for the organization of mutual orientation. *Semiotica* 62 (1/2), 29–49.
- Goodwin, C., 2017. *Co-Operative Action*. Cambridge University Press, Cambridge. <https://doi.org/10.1017/9781139016735>.
- Goldstein, D.M., Hall, K., 2021. Darwin's hug Ideologies of gesture in the science of human exceptionalism. *HAU: Journal of Ethnographic Theory* 11 (2), 693–712.
- Gurney, L., Demuro, E., 2019. Tracing new ground, from language to languaging, and from languaging to assemblages: rethinking languaging through the multilingual and ontological turns. *Int. J. Multiling.*, 1–20. <https://doi.org/10.1080/14790718.2019.1689982>.
- Haraway, D., 2008. *When Species Meet*. University of Minnesota Press, Minneapolis, London.
- Hare, B., Brown, M., Williamson, C., Tomasello, M., 2002. The domestication of social cognition in dogs. *Science* 298, 1634–1636.
- Hauser, M., Chomsky, N.W., Fitch, T., 2002. The faculty of language: what is it, who has it, and how did it evolve? *Science* 298 (Issue 5598), 1569–1579, 22 Nov 2002.
- Hockett, C.F., 1958. *A Course in Modern Linguistics*. Macmillan, New York.
- Hodgetts, T., Lorimer, J., 2015. Methodologies for animals' geographies: cultures, communication and genomics. *Cult. Geogr.* 22 (2), 285–295.
- Hua, Zhua, Otsuji, Emi, Pennycook, Alastair, 2017. Multilingual, multisensory, and multimodal repertoires in corner shops, streets and markets: introduction. *Soc. Semiotic* 27 (4), 383–393.
- Jahns, G., 2012. Computational intelligence to recognize animal vocalization and diagnose animal health status. In: Moewes, C., Nürnberger, A. (Eds.), *Computational Intelligence in Intelligent Data Analysis*. Springer, Berlin, pp. 239–249.
- Jahns, G., et al., 1997. Sound analysis to recognize different animals. In: *IFAC Proceedings Mathematical and Control Applications in Agriculture and Horticulture*. Hannover, Germany.
- Johnstone, B., 2000. *Qualitative Methods in Sociolinguistics*. Oxford University Press, Oxford.
- Jørgensen, J.N., 2008. Polylingual languaging around and among children and adolescents. *Int. J. Multiling.*, 161–176.
- Keevallik, L., 2018. What does embodied interaction tell us about grammar? *Res. Lang. Soc. Interact.* 51 (1), 1–21 <https://doi.org/10.1080/08351813.2018.1413887>.
- Kendon, A., 1967. Some functions of gaze direction in social interaction. *Acta Psychol.* 26, 22–63. [https://doi.org/10.1016/0001-6918\(67\)90005-4](https://doi.org/10.1016/0001-6918(67)90005-4).
- Kendon, A., 2014. Semiotic diversity in utterance production and the concept of 'language'. *Philosophical Transactions of the royal society B* 369, 20130293 <https://doi.org/10.1098/rstb.2013.0293>.
- Kirksey, S.E., Heimreich, S., 2010. The emergence of multispecies research. *Cult. Anthropol.* 25, 545–576.
- Levinson, Stephen C., Holler, Judith, 2014. The origin of human multi-modal communication. *Philosophical Transactions of the royal society B* 369, 20130302. <https://doi.org/10.1098/rstb.2013.0302>.
- McElligott, A.G., O'Keefe, K.H., Green, A.C., 2020. Kangaroos display gazing and gaze alternations during an unsolvable problem task. *Biol. Lett.* 16, 20200607.
- Meijer, E., 2019. *When Animals Speak: Toward an Interspecies Democracy*. New York University Press, New York.
- Mondada, L., 2016. Challenges of multimodality: language and the body in social interaction. *J. Sociolinguistics* 20 (3), 336–366.
- Mondada, L., 2018. Multiple temporalities of language and body in interaction: challenges for transcribing multimodality. *Res. Lang. Soc. Interact.* 51 (1), 85–106. <https://doi.org/10.1080/08351813.2018.1413878>.
- Mondémé, C., 2021. Why study turn-taking sequences in interspecies interactions? *J. Theor. Soc. Behav.*, 1–19 <https://doi.org/10.1111/jtsb.12295>.
- Marino, L., Allen, K., 2017. The psychology of cows. *Animal Behavior and Cognition* 4 (4), 474–498.
- Nawroth, C., Brett, J.M., McElligott, A.G., 2016. Goats display audience-dependent human directed gazing behaviour in a problem-solving task. *Biol. Lett.* 12 (7), 1–4.
- Notermans, C., 2019. Prayers of cow dung. Women sculpturing fertile environments in rural Rajasthan (India). *Religions* 10 (71), 1–25. <https://doi.org/10.3390/rel10020071>.
- Ochs, E., Schieffelin, B., Platt, M.L., 1979. Propositions across utterances and speakers. In: Ochs, E., Schieffelin, B. (Eds.), *Developmental Pragmatics*. Academic Press, London, pp. 251–268.
- Otsuji, E., Pennycook, A., 2010. Metrolingualism: fixity, fluidity and language in flux. *Int. J. Multiling.* 7 (3), 240–254.
- Padilla de la Torre, M., Briefer, E.F., Reader, T., McElligott, A., 2015. Acoustic analysis of cattle (*Bos taurus*) mother-offspring contact calls from a source-filter theory perspective. *Appl. Anim. Behav. Sci.* 163, 58–68.
- Pennycook, A., 2018. *Posthumanist Applied Linguistics*. Routledge, London/New York.
- Phillips, C., 2007. *Cattle Behaviour and Welfare*. Blackwell, Malden.
- Rossano, F., 2013. Gaze in conversation. In: Sidnell, J., Stivers, T. (Eds.), *The Handbook of Conversational Analysis*. Blackwell, Malden, pp. 308–329.
- Seymour, M., Wolch, J., 2009. 'a little bird told me' Approaching animals through qualitative methods. In: DeLyser, D., Herbert, S., Aitken, S., Crang, M., McDowell, L. (Eds.), *The Sage Handbook of Qualitative Geography*. Sage Publications, London, pp. 305–320.
- Schegloff, E., 1968. Sequencing in conversational openings. *Am. Anthropol.* 70 (6), 1075–1095.
- Schegloff, E.A., 2007. *Sequence Organization in Interaction: A Primer in Conversation Analysis*. Cambridge University press, Cambridge.
- Stukenbrock, A., 2020. Deixis, meta-Perceptive gaze practices, and the interactional achievement of joint attention. *Front. Psychol.* 11, 1779. <https://doi.org/10.3389/fpsyg.2020.01779>.
- Thibault, J.P., 2011. First-order languaging dynamics and second order language: the distributed language view. *Ecol. Psychol.* 23, 210–245.
- Thompson, P.B., 2021. The vanishing ethics of husbandry. In: Bovenkerk, B., Keulartz, J. (Eds.), *Animals in Our Midst: The Challenges of Co-existing with Animals in the Anthropocene*. Springer Verlag, pp. 203–221.